

**Project 2148 - Final**

**STATE WATER CONTROL BOARD**

**Triennial Review Remaining Issues - BACH (Bacteria, Cadmium and Human Health Criteria)**

**9VAC25-260-140. Criteria for surface water.**

A. Instream water quality conditions shall not be acutely<sup>1</sup> or chronically<sup>2</sup> toxic except as allowed in 9VAC25-260-20 B (mixing zones). The following are definitions of acute and chronic toxicity conditions:

"Acute toxicity" means an adverse effect that usually occurs shortly after exposure to a pollutant. Lethality to an organism is the usual measure of acute toxicity. Where death is not easily detected, immobilization is considered equivalent to death.

"Chronic toxicity" means an adverse effect that is irreversible or progressive or occurs because the rate of injury is greater than the rate of repair during prolonged exposure to a pollutant. This includes low level, long-term effects such as reduction in growth or reproduction.

B. The following table is a list of numerical water quality criteria for specific parameters.

Table of Parameters <sup>6, 7</sup>						
PARAMETER CAS Number	USE DESIGNATION					
	AQUATIC LIFE				HUMAN HEALTH	
	FRESHWATER		SALTWATER		Public Water Supply <sup>3</sup>	All Other Surface Waters <sup>4</sup>
	Acute <sup>1</sup>	Chronic <sup>2</sup>	Acute <sup>1</sup>	Chronic <sup>2</sup>		
Acenaphthene (µg/l) 83329					70	90
Acrolein (µg/l) 107028	3.0	3.0			3	400
Acrylonitrile (µg/l) 107131 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .					0.61	70
Aldrin (µg/l) 309002 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .	3.0		1.3		0.0000077	0.0000077
Ammonia (µg/l) 766-41-7 Chronic criterion is a 30- day average concentration not to be exceeded more than once every three years						

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	Acute <sup>1</sup>	Chronic <sup>2</sup>	Acute <sup>1</sup>	Chronic <sup>2</sup>		
on the average.(see 9VAC25-260-155)						
Anthracene (µg/l) 120127					300	400
Antimony (µg/l) 7440360					5.6	640
Arsenic (µg/l) <sup>5</sup> 7440382	340	150	69	36	10	
Bacteria (see 9VAC25-260-160 and 9VAC25-260-170)						
Barium (µg/l) 7440393					2,000	
Benzene (µg/l) 71432 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup>					5.8	160
Benzidine (µg/l) 92875 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup>					0.0014	0.11
Benzo (a) anthracene (µg/l) 56553 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup>					0.012	0.013
Benzo (b) fluoranthene (µg/l) 205992 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup>					0.012	0.013

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	Acute <sup>1</sup>	Chronic <sup>2</sup>	Acute <sup>1</sup>	Chronic <sup>2</sup>		
Benzo (k) fluoranthene (µg/l) 207089 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup>					0.12	0.13
Benzo (a) pyrene (µg/l) 50328 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup>					0.0012	0.0013
Bis2-Chloroethyl Ether (µg/l) 111444 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup>					0.30	22
Bis (chloromethyl) Ether 542881 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup>					0.0015	0.17
Bis2-Chloroisopropyl Ether (Bis (2-Chloro-1-methylethyl) Ether) (µg/l) 108601					200	4,000
Bis2-Ethylhexyl Phthalate (µg/l) 117817 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> . Synonym = Di-2- Ethylhexyl Phthalate.					3.2	3.7
Bromoform (µg/l) 75252 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .					70	1,200

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	Acute <sup>1</sup>	Chronic <sup>2</sup>	Acute <sup>1</sup>	Chronic <sup>2</sup>		
Butyl benzyl phthalate (µg/l) 85687					1.0	1.0
Cadmium (µg/l) <sup>5</sup> 7440439 Freshwater values are a function of total hardness as calcium carbonate (CaCO <sub>3</sub> ) mg/l and the WER. The minimum hardness allowed for use in the equation below shall be 25 and the maximum hardness shall be 400 even when the actual ambient hardness is less than 25 or greater than 400. Freshwater acute criterion (µg/l) $WER e^{(0.9789[\ln(\text{hardness})]-3.866)} (CF_a)$ Freshwater chronic criterion (µg/l) $WER e^{(0.7977[\ln(\text{hardness})]-3.909)} (CF_c)$ WER = Water Effect Ratio = 1 unless determined otherwise under 9VAC25-260-140 F e = natural antilogarithm ln = natural logarithm CF = conversion factor a (acute) or c (chronic) $CF_a = 1.136672 - [(\ln \text{hardness})(0.041838)]$ $CF_c = 1.101672 - [(\ln \text{hardness})(0.041838)]$	1.8 CaCO <sub>3</sub> = 100	0.72 CaCO <sub>3</sub> = 100	33 X WER	7.9 X WER	5	

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	Acute <sup>1</sup>	Chronic <sup>2</sup>	Acute <sup>1</sup>	Chronic <sup>2</sup>		
Carbon tetrachloride (µg/l) 56235 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .					4.0	50
Carbaryl (µg/l) 63252	2.1	2.1	1.6			
Chlordane (µg/l) 57749 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .	2.4	0.0043	0.09	0.0040	0.0031	0.0032
Chloride (µg/l) 16887006 Human health criterion to maintain acceptable taste and aesthetic quality and applies at the drinking water intake. Chloride criteria do not apply in Class II transition zones (see subsection C of this section).	860,000	230,000			250,000	
Chlorine, Total Residual (µg/l) 7782505 In DGIF class i and ii trout waters (9VAC25-260-390 through 9VAC25-260- 540) or waters with threatened or endangered species are subject to the halogen ban (9VAC25-260-110).	19 See 9VAC25- 260-110	11 See 9VAC25- 260-110				
Chlorine Produced Oxidant (µg/l) 7782505			13	7.5		

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	Acute <sup>1</sup>	Chronic <sup>2</sup>	Acute <sup>1</sup>	Chronic <sup>2</sup>		
Chlorobenzene (µg/l) 108907					100	800
Chlorodibromomethane (µg/l) 124481 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .					8.0	210
Chloroform (µg/l) 67663					60	2,000
2-Chloronaphthalene (µg/l) 91587					800	1,000
2-Chlorophenol (µg/l) 95578					30	800
Chlorpyrifos (µg/l) 2921882	0.083	0.041	0.011	0.0056		

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	Acute <sup>1</sup>	Chronic <sup>2</sup>	Acute <sup>1</sup>	Chronic <sup>2</sup>		
Chromium III (µg/l) <sup>5</sup> 16065831 Freshwater values are a function of total hardness as calcium carbonate CaCO <sub>3</sub> mg/l and the WER. The minimum hardness allowed for use in the equation below shall be 25 and the maximum hardness shall be 400 even when the actual ambient hardness is less than 25 or greater than 400. Freshwater acute criterion µg/l WER $[e^{\{0.8190[\ln(\text{hardness})]+3.7256\}}]$ (CF <sub>a</sub> ) Freshwater chronic criterion µg/l WER $[e^{\{0.8190[\ln(\text{hardness})]+0.6848\}}]$ (CF <sub>c</sub> ) WER = Water Effect Ratio = 1 unless determined otherwise under 9VAC25-260-140.F e = natural antilogarithm ln = natural logarithm CF = conversion factor a (acute) or c (chronic) CF <sub>a</sub> = 0.316 CF <sub>c</sub> =0.860	570 (CaCO <sub>3</sub> = 100)	74 (CaCO <sub>3</sub> = 100)			100 (total Cr)	
Chromium VI (µg/l) <sup>5</sup> 18540299	16	11	1,100	50		

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	Acute <sup>1</sup>	Chronic <sup>2</sup>	Acute <sup>1</sup>	Chronic <sup>2</sup>		
Chrysene (µg/l) 218019 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .					1.2	1.3



<p>Copper (µg/l)<sup>5</sup> 7440508</p> <p>Freshwater values are a function of total hardness as calcium carbonate CaCO<sub>3</sub> mg/l and the WER. The minimum hardness allowed for use in the equation below shall be 25 and the maximum hardness shall be 400 even when the actual ambient hardness is less than 25 or greater than 400.</p> <p>Freshwater acute criterion (µg/l) WER [e<sup>{0.9422[ln(hardness)]-1.700}</sup>] (CF<sub>a</sub>)</p> <p>Freshwater chronic criterion (µg/l) WER [e<sup>{0.8545[ln(hardness)]-1.702}</sup>] (CF<sub>c</sub>)</p> <p>WER = Water Effect Ratio = 1 unless determined otherwise under 9VAC25-260-140 F.</p> <p>e = natural antilogarithm ln = natural logarithm CF = conversion factor a (acute) or c (chronic) CF<sub>a</sub> = 0.960 CF<sub>c</sub> = 0.960</p> <p>Alternate copper criteria in freshwater: the freshwater criteria for copper can also be calculated using the EPA 2007 Biotic Ligand Model (See 9VAC25-260-140 G).</p> <p>Acute saltwater criterion is a 24-hour average not to be exceeded more</p>	<p>13 CaCO<sub>3</sub> = 100</p>	<p>9.0 CaCO<sub>3</sub> = 100</p>	<p>9.3 X WER</p>	<p>6.0 X WER</p>	<p>1,300</p>	
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	Acute <sup>1</sup>	Chronic <sup>2</sup>	Acute <sup>1</sup>	Chronic <sup>2</sup>		
than once every three years on the average.						
Cyanide, Free (µg/l) 57125	22	5.2	1.0	1.0	4	400
DDD (µg/l) 72548 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .					0.0012	0.0012
DDE (µg/l) 72559 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .					0.00018	0.00018
DDT (µg/l) 50293 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> . Total concentration of DDT and metabolites shall not exceed aquatic life criteria.	1.1	0.0010	0.13	0.0010	0.00030	0.00030
Demeton (µg/l) 8065483		0.1		0.1		
Diazinon (µg/l) 333415	0.17	0.17	0.82	0.82		
Dibenz (a, h) anthracene (µg/l) 53703 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .					0.0012	0.0013
1,2-Dichlorobenzene (µg/l) 95501					1,000	3,000
1,3-Dichlorobenzene (µg/l) 541731					7	10

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1,4 Dichlorobenzene (µg/l) 106467					300	900
3,3 Dichlorobenzidine (µg/l) 91941 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .					0.49	1.5
Dichlorobromomethane (µg/l) 75274 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .					9.5	270
1,2 Dichloroethane (µg/l) 107062 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .					99	6,500
1,1 Dichloroethylene (µg/l) 75354					300	20,000
1,2-trans-dichloroethylene (µg/l) 156605					100	4,000
2,4 Dichlorophenol (µg/l) 120832					10	60
2,4 Dichlorophenoxy acetic acid (Chlorophenoxy Herbicide) (2,4-D) (µg/l) 94757					1,300	12,000
1,2-Dichloropropane (µg/l) 78875 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .					9.0	310

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	Acute <sup>1</sup>	Chronic <sup>2</sup>	Acute <sup>1</sup>	Chronic <sup>2</sup>		
1,3-Dichloropropene (µg/l) 542756 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .					2.7	120
Dieldrin (µg/l) 60571 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .	0.24	0.056	0.71	0.0019	0.000012	0.000012
Diethyl Phthalate (µg/l) 84662					600	600
2,4 Dimethylphenol (µg/l) 105679					100	3,000
Dimethyl Phthalate (µg/l) 131113					2,000	2,000
Di-n-Butyl Phthalate (µg/l) 84742					20	30
2,4 Dinitrophenol (µg/l) 51285					10	300
Dinitrophenols (µg/l) 25550587					10	1,000
2-Methyl-4,6-Dinitrophenol (µg/l) 534521					2	30
2,4 Dinitrotoluene (µg/l) 121142 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .					0.49	17
Dioxin 2, 3, 7, 8- tetrachlorodibenzo-p-dioxin (µg/l) 1746016					5.0 E-8	5.1 E-8

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	Acute <sup>1</sup>	Chronic <sup>2</sup>	Acute <sup>1</sup>	Chronic <sup>2</sup>		
1,2-Diphenylhydrazine (µg/l) 122667 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .					0.3	2.0
Dissolved Oxygen (µg/l) (See 9VAC25-260-50)						
Alpha-Endosulfan (µg/l) 959988 Total concentration alpha and beta-endosulfan shall not exceed aquatic life criteria.	0.22	0.056	0.034	0.0087	20	30
Beta-Endosulfan (µg/l) 33213659 Total concentration alpha and beta-endosulfan shall not exceed aquatic life criteria.	0.22	0.056	0.034	0.0087	20	40
Endosulfan Sulfate (µg/l) 1031078					20	40
Endrin (µg/l) 72208	0.086	0.036	0.037	0.0023	0.03	0.03
Endrin Aldehyde (µg/l) 7421934					1	1
Ethylbenzene (µg/l) 100414					68	130
Fecal Coliform (see 9VAC25-260-160)						
Fluoranthene (µg/l) 206440					20	20
Fluorene (µg/l) 86737					50	70

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Foaming Agents (µg/l) Criterion measured as methylene blue active substances. Criterion to maintain acceptable taste, odor, or aesthetic quality of drinking water and applies at the drinking water intake.					500	
Guthion (µg/l) 86500		0.01		0.01		
Heptachlor (µg/l) 76448 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .	0.52	0.0038	0.053	0.0036	0.000059	0.000059
Heptachlor Epoxide (µg/l) 1024573 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .	0.52	0.0038	0.053	0.0036	0.00032	0.00032
Hexachlorobenzene (µg/l) 118741 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .					0.00079	0.00079
Hexachlorobutadiene (µg/l) 87683 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .					0.1	0.1
Hexachlorocyclohexane Alpha-BHC (µg/l) 319846 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .					0.0036	0.0039

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Hexachlorocyclohexane Beta-BHC (µg/l) 319857 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .					0.080	0.14
Hexachlorocyclohexane (µg/l) (Lindane) Gamma-BHC 58899	0.95		0.16		4.2	4.4
Hexachlorocyclohexane (HCH)-Technical (µg/l) 608731 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .					0.066	0.1
Hexachlorocyclopentadiene (µg/l) 77474					4	4
Hexachloroethane (µg/l) 67721 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .					1	1
Hydrogen sulfide (µg/l) 7783064		2.0		2.0		
Indeno (1,2,3,-cd) pyrene (µg/l) 193395 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .					0.012	0.013

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Iron (µg/l) 7439896 Criterion to maintain acceptable taste, odor, or aesthetic quality of drinking water and applies at the drinking water intake.					300	
Isophorone (µg/l) 78591 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .					340	18,000
Kepone (µg/l) 143500		zero		zero		



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Lead (µg/l) <sup>5</sup> 7439921 Freshwater values are a function of total hardness as calcium carbonate CaCO <sub>3</sub> mg/l and the water effect ratio. The minimum hardness allowed for use in the equation below shall be 25 and the maximum hardness shall be 400 even when the actual ambient hardness is less than 25 or greater than 400. Freshwater acute criterion (µg/l) WER [e <sup>{1.273[ln(hardness)]-1.084}</sup> ](CF <sub>a</sub> ) Freshwater chronic criterion (µg/l) WER [e <sup>{1.273[ln(hardness)]-3.259}</sup> ](CF <sub>c</sub> ) WER = Water Effect Ratio = 1 unless determined otherwise under 9VAC25-260-140 F e = natural antilogarithm ln = natural logarithm CF = conversion factor a (acute) or c (chronic) CF <sub>a</sub> = 1.46203-[(ln hardness)(0.145712)] CF <sub>c</sub> = 1.46203-[(ln hardness)(0.145712)]	94 CaCO <sub>3</sub> = 100	11 CaCO <sub>3</sub> = 100	230 X WER	8.8 X WER	15	
Malathion (µg/l) 121755		0.1		0.1		

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Mercury (µg/l) 5 7439976	1.4	0.77	1.8	0.94		
Methyl Bromide (µg/l) 74839					100	10,000
3-Methyl-4-Chlorophenol 59507					500	2,000
Methyl Mercury (Fish Tissue Criterion mg/kg) 8 22967926					0.30	0.30
Methylene Chloride (µg/l) 75092 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> . Synonym = Dichloromethane					20	1,000
Methoxychlor (µg/l) 72435		0.03		0.03	0.02	0.02
Mirex (µg/l) 2385855		zero		zero		

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Nickel (µg/l) <sup>5</sup> 744002 Freshwater values are a function of total hardness as calcium carbonate CaCO <sub>3</sub> mg/l and the WER. The minimum hardness allowed for use in the equation below shall be 25 and the maximum hardness shall be 400 even when the actual ambient hardness is less than 25 or greater than 400. Freshwater acute criterion (µg/l) WER $[e^{\{0.8460[\ln(\text{hardness})] + 1.312\}}]$ (CF <sub>a</sub> ) Freshwater chronic criterion (µg/l) WER $[e^{\{0.8460[\ln(\text{hardness})] - 0.8840\}}]$ (CF <sub>c</sub> ) WER = Water Effect Ratio = 1 unless determined otherwise under 9VAC25-260-140 F e = natural antilogarithm ln = natural logarithm CF = conversion factor a (acute) or c (chronic) CF <sub>a</sub> = 0.998 CF <sub>c</sub> = 0.997	180 CaCO <sub>3</sub> = 100	20 CaCO <sub>3</sub> = 100	74 X WER	8.2 X WER	610	4,600
Nitrate as N (µg/l) 14797558					10,000	
Nitrobenzene (µg/l) 98953					10	600

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	Acute <sup>1</sup>	Chronic <sup>2</sup>	Acute <sup>1</sup>	Chronic <sup>2</sup>		
N-Nitrosodimethylamine (µg/l) 62759 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .					0.0069	30
N-Nitrosodiphenylamine (µg/l) 86306 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .					33	60
N-Nitrosodi-n-propylamine (µg/l) 621647 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .					0.050	5.1
Nonylphenol (µg/l) 84852153	28	6.6	7.0	1.7		
Parathion (µg/l) 56382	0.065	0.013				
PCB Total (µg/l) 1336363 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .		0.014		0.030	0.00064	0.00064
Pentachlorobenzene (µg/l) 608935					0.1	0.1

Table of Parameters <sup>6, 7</sup>						
PARAMETER CAS Number	USE DESIGNATION					
	AQUATIC LIFE				HUMAN HEALTH	
	FRESHWATER		SALTWATER		Public Water Supply <sup>3</sup>	All Other Surface Waters <sup>4</sup>
	Acute <sup>1</sup>	Chronic <sup>2</sup>	Acute <sup>1</sup>	Chronic <sup>2</sup>		
Pentachlorophenol (µg/l) 87865 Known or suspected carcinogen; human health criteria risk level at 10 <sup>-5</sup> . Freshwater acute criterion (µg/l) e <sup>(1.005(pH)-4.869)</sup> Freshwater chronic criterion (µg/l) e <sup>(1.005(pH)-5.134)</sup>	8.7 pH = 7.0	6.7 pH = 7.0	13	7.9	0.3	0.4
pH See 9VAC25-260-50						
Phenol (µg/l) 108952					4,000	300,000
Phosphorus Elemental (µg/l) 7723140				0.10		
Pyrene (µg/l) 129000					20	4,000 30
Radionuclides Gross Alpha Particle Activity (pCi/L) Beta Particle & Photon Activity (mrem/yr) (formerly man-made radionuclides) Combined Radium 226 and 228 (pCi/L) Uranium (µg/L)					15  4  5  30	

Table of Parameters <sup>6, 7</sup>						
PARAMETER CAS Number	USE DESIGNATION					
	AQUATIC LIFE				HUMAN HEALTH	
	FRESHWATER		SALTWATER		Public Water Supply <sup>3</sup>	All Other Surface Waters <sup>4</sup>
	Acute <sup>1</sup>	Chronic <sup>2</sup>	Acute <sup>1</sup>	Chronic <sup>2</sup>		
Selenium (µg/l) <sup>5</sup> 7782492 WER shall not be used for freshwater acute and chronic criteria. Freshwater criteria expressed as total recoverable.	20	5.0	290 X WER	71 X WER	170	4,200
Silver (µg/l) <sup>5</sup> 7440224 Freshwater values are a function of total hardness as calcium carbonate (CaCO <sub>3</sub> ) mg/l and the WER. The minimum hardness allowed for use in the equation below shall be 25 and the maximum hardness shall be 400 even when the actual ambient hardness is less than 25 or greater than 400. Freshwater acute criterion (µg/l) WER $[e^{\{1.72[\ln(\text{hardness})]-6.52\}}]$ (CF <sub>a</sub> ) WER = Water Effect Ratio = 1 unless determined otherwise under 9VAC25-260-140 F e = natural antilogarithm ln = natural logarithm CF = conversion factor a (acute) or c (chronic) CF <sub>a</sub> = 0.85	3.4; CaCO <sub>3</sub> = 100		1.9 X WER			

Table of Parameters <sup>6, 7</sup>						
PARAMETER CAS Number	USE DESIGNATION					
	AQUATIC LIFE				HUMAN HEALTH	
	FRESHWATER		SALTWATER		Public Water Supply <sup>3</sup>	All Other Surface Waters <sup>4</sup>
	Acute <sup>1</sup>	Chronic <sup>2</sup>	Acute <sup>1</sup>	Chronic <sup>2</sup>		
Sulfate (µg/l) Criterion to maintain acceptable taste, odor, or aesthetic quality of drinking water and applies at the drinking water intake.					250,000	
Temperature See 9VAC25-260-50						
1,2,4,5-Tetrachlorobenzene 95943					0.03	0.03
1,1,2,2-Tetrachloroethane (µg/l) 79345 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .					2.0	30
Tetrachloroethylene (µg/l) 127184 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .					100	290
Thallium (µg/l) 7440280					0.24	0.47
Toluene (µg/l) 108883					57	6,000 520
Total Dissolved Solids (µg/l) Criterion to maintain acceptable taste, odor or aesthetic quality of drinking water and applies at the drinking water intake.					500,000	

Table of Parameters <sup>6, 7</sup>						
PARAMETER CAS Number	USE DESIGNATION					
	AQUATIC LIFE				HUMAN HEALTH	
	FRESHWATER		SALTWATER		Public Water Supply <sup>3</sup>	All Other Surface Waters <sup>4</sup>
	Acute <sup>1</sup>	Chronic <sup>2</sup>	Acute <sup>1</sup>	Chronic <sup>2</sup>		
Toxaphene (µg/l) 8001352 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .	0.73	0.0002	0.21	0.0002	0.0070	0.0071
Tributyltin (µg/l) 60105	0.46	0.072	0.42	0.0074		
1, 2, 4 Trichlorobenzene (µg/l) 120821 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .					0.71	0.76
1,1,1-Trichloroethane 71556					10,000	200,000
1,1,2-Trichloroethane (µg/l) 79005 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .					5.5	89
Trichloroethylene (µg/l) 79016 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .					6.0	70
2, 4, 5 –Trichlorophenol 95954					300	600
2, 4, 6-Trichlorophenol (µg/l) 88062 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .					15	28
2-(2, 4, 5-Trichlorophenoxy) propionic acid (Silvex) (µg/l) 93721					100	400



Table of Parameters <sup>6, 7</sup>						
PARAMETER CAS Number	USE DESIGNATION					
	AQUATIC LIFE				HUMAN HEALTH	
	FRESHWATER		SALTWATER		Public Water Supply <sup>3</sup>	All Other Surface Waters <sup>4</sup>
	Acute <sup>1</sup>	Chronic <sup>2</sup>	Acute <sup>1</sup>	Chronic <sup>2</sup>		
Vinyl Chloride (µg/l) 75014 Known or suspected carcinogen; human health criteria at risk level 10 <sup>-5</sup> .					0.22	16

Table of Parameters<sup>6, 7</sup>

PARAMETER CAS Number	USE DESIGNATION					
	AQUATIC LIFE				HUMAN HEALTH	
	FRESHWATER		SALTWATER		Public Water Supply <sup>3</sup>	All Other Surface Waters <sup>4</sup>
	Acute <sup>1</sup>	Chronic <sup>2</sup>	Acute <sup>1</sup>	Chronic <sup>2</sup>		
Zinc (µg/l) <sup>5</sup> 7440666 Freshwater values are a function of total hardness as calcium carbonate (CaCO <sub>3</sub> ) mg/l and the WER. The minimum hardness allowed for use in the equation below shall be 25 and the maximum, hardness shall be 400 even when the actual ambient hardness is less than 25 or greater than 400. Freshwater acute criterion (µg/l) WER $[e^{\{0.8473[\ln(\text{hardness})]+0.884\}}](CF_a)$ Freshwater chronic criterion (µg/l) WER $[e^{\{0.8473[\ln(\text{hardness})]+0.884\}}](CF_c)$ WER = Water Effect Ratio = 1 unless determined otherwise under 9VAC25-260-140 F e = natural antilogarithm ln = natural logarithm CF = conversion factor a (acute) or c (chronic) CF <sub>a</sub> = 0.978 CF <sub>c</sub> = 0.986	120 CaCO <sub>3</sub> = 100	120 CaCO <sub>3</sub> = 100	90 X WER	81 X WER	7,400	26,000

<sup>1</sup>One hour average concentration not to be exceeded more than once every 3 years on the average, unless otherwise noted.

<sup>2</sup>Four-day average concentration not to be exceeded more than once every 3 years on the average, unless otherwise noted.

<sup>3</sup>Criteria have been calculated to protect human health from toxic effects through drinking water and fish consumption, unless otherwise noted and apply in segments designated as PWS in 9VAC25-260-390 through 9VAC25-260-540.

<sup>4</sup>Criteria have been calculated to protect human health from toxic effects through fish consumption, unless otherwise noted and apply in all other surface waters not designated as PWS in 9VAC25-260-390 through 9VAC25-260-540.

<sup>5</sup>Acute and chronic saltwater and freshwater aquatic life criteria apply to the biologically available form of the metal and apply as a function of the pollutant's water effect ratio (WER) as defined in 9VAC25-260-140 F (WER X criterion). Metals measured as dissolved shall be considered to be biologically available, or, because local receiving water characteristics may otherwise affect the biological availability of the metal, the biologically available equivalent measurement of the metal can be further defined by determining a water effect ratio (WER) and multiplying the numerical value shown in 9VAC25-260-140 B by the WER. Refer to 9VAC25-260-140 F. Values displayed above in the table are examples and correspond to a WER of 1.0. Metals criteria have been adjusted to convert the total recoverable fraction to dissolved fraction using a conversion factor. Criteria that change with hardness have the conversion factor listed in the table above.

<sup>6</sup>The flows listed below are default design flows for calculating steady state wasteload allocations unless statistically valid methods are employed which demonstrate compliance with the duration and return frequency of the water quality criteria.

Aquatic Life:

Acute criteria	1Q10
Chronic criteria	7Q10
Chronic criteria (ammonia)	30Q10

Human Health:

Noncarcinogens	30Q5
Carcinogens	Harmonic mean

The following are defined for this section:

"1Q10" means the lowest flow averaged over a period of 1 day which on a statistical basis can be expected to occur once every 10 climatic years.

"7Q10" means the lowest flow averaged over a period of 7 consecutive days that can be statistically expected to occur once every 10 climatic years.

"30Q5" means the lowest flow averaged over a period of 30 consecutive days that can be statistically expected to occur once every 5 climatic years.

"30Q10" means the lowest flow averaged over a period of 30 consecutive days that can be statistically expected to occur once every 10 climatic years.

"Averaged" means an arithmetic mean.

"Climatic year" means a year beginning on April 1 and ending on March 31.

<sup>7</sup>The criteria listed in this table are two significant digits. For other criteria that are referenced to other sections of this regulation in this table, all numbers listed as criteria values are significant.

<sup>8</sup>The fish tissue criterion for methylmercury applies to a concentration of 0.30 mg/kg as wet weight in edible tissue for species of fish and shellfish resident in a waterbody that are commonly eaten in the area and have commercial, recreational, or subsistence value.

C. Application of freshwater and saltwater numerical criteria. The numerical water quality criteria listed in subsection B of this section (excluding dissolved oxygen, pH, temperature) shall be applied according to the following classes of waters (see 9VAC25-260-50) and boundary designations:

CLASS OF WATERS	NUMERICAL CRITERIA
I and II (Estuarine Waters)	Saltwater criteria apply
II (Transition Zone)	More stringent of either the freshwater or saltwater criteria apply
II (Tidal Freshwater), III, IV, V, VI and VII	Freshwater criteria apply

The following describes the boundary designations for Class II, (estuarine, transition zone and tidal freshwater waters) by river basin:

1. Rappahannock Basin. Tidal freshwater is from the fall line of the Rappahannock River to the upstream boundary of the transition zone including all tidal tributaries that enter the tidal freshwater Rappahannock River.

Transition zone upstream boundary – N38° 4' 56.59"/W76° 58' 47.93" (430 feet east of Hutchinson Swamp) to N38° 5' 23.33"/W76° 58' 24.39" (0.7 miles upstream of Peedee Creek).

Transition zone downstream boundary – N37° 58' 45.80"/W76° 55' 28.75" (1,000 feet downstream of Jenkins Landing) to N37° 59' 20.07"/W76° 53' 45.09" (0.33 miles upstream of Mulberry Point). All tidal waters that enter the transition zone are themselves transition zone waters.

Estuarine waters are from the downstream boundary of the transition zone to the mouth of the Rappahannock River (Buoy 6), including all tidal tributaries that enter the estuarine waters of the Rappahannock River.

2. York Basin. Tidal freshwater is from the fall line of the Mattaponi River at N37° 47' 20.03"/W77° 6' 15.16" (800 feet upstream of the Route 360 bridge in Aylett) to the upstream boundary of the Mattaponi River transition zone, and from the fall line of the Pamunkey River at N37° 41' 22.64"/W77° 12' 50.83" (2,000 feet upstream of Totopotomoy Creek) to the upstream boundary of the Pamunkey River transition zone, including all tidal tributaries that enter the tidal freshwaters of the Mattaponi and Pamunkey Rivers.

Mattaponi River transition zone upstream boundary – N37° 39' 29.65"/W76° 52' 53.29" (1,000 feet upstream of Mitchell Hill Creek) to N37° 39' 24.20"/W76° 52' 55.87" (across from Courthouse Landing).

Mattaponi River transition zone downstream boundary – N37° 32' 19.76"/W76° 47' 29.41" (old Lord Delaware Bridge, west side) to N37° 32' 13.25"/W76° 47' 10.30" (old Lord Delaware Bridge, east side).

Pamunkey River transition zone upstream boundary – N37° 32' 36.63"/W76° 58' 29.88" (Cohoke Marsh, 0.9 miles upstream of Turkey Creek) to N37° 32' 36.51"/W76° 58' 36.48" (0.75 miles upstream of creek at Cook Landing).

Pamunkey River transition zone downstream boundary – N37° 31' 57.90"/W76° 48' 38.22" (old Eltham Bridge, west side) to N37° 32' 6.25"/W76° 48' 18.82" (old Eltham Bridge, east side).

All tidal tributaries that enter the transition zones of the Mattaponi and Pamunkey Rivers are themselves in the transition zone.

Estuarine waters are from the downstream boundary of the transition zones of the Mattaponi and Pamunkey Rivers to the mouth of the York River (Tue Marsh Light) including all tidal tributaries that enter the estuarine waters of the York River.

3. James Basin. Tidal freshwater is from the fall line of the James River in the City of Richmond upstream of Mayo Bridge to the upstream boundary of the transition zone, including all tidal tributaries that enter the tidal freshwater James River.

James River transition zone upstream boundary – N37° 14' 28.25"/W76° 56' 44.47" (at Tettington) to N37° 13' 38.56"/W76° 56' 47.13" (0.3 miles downstream of Sloop Point).

Chickahominy River transition zone upstream boundary – N37° 25' 44.79"/W77° 1' 41.76" (Holly Landing).

Transition zone downstream boundary – N37° 12' 7.23"/W76° 37' 34.70" (near Carters Grove Home, 1.25 miles downstream of Grove Creek) to N37° 9' 17.23"/W76° 40' 13.45" (0.7 miles upstream of Hunnicutt Creek). All tidal waters that enter the transition zone are themselves transition zone waters.

Estuarine waters are from the downstream transition zone boundary to the mouth of the James River (Buoy 25) including all tidal tributaries that enter the estuarine waters of the James River.

4. Potomac Basin. Tidal freshwater includes all tidal tributaries that enter the Potomac River from its fall line at the Chain Bridge (N38° 55' 46.28"/W77° 6' 59.23") to the upstream transition zone boundary near Quantico, Virginia.

Transition zone includes all tidal tributaries that enter the Potomac River from N38° 31' 27.05"/W77° 17' 7.06" (midway between Shipping Point and Quantico Pier) to N38° 23' 22.78"/W77° 1' 45.50" (one mile southeast of Mathias Point).

Estuarine waters includes all tidal tributaries that enter the Potomac River from the downstream transition zone boundary to the mouth of the Potomac River (Buoy 44B).

5. Chesapeake Bay, Atlantic Ocean, and small coastal basins. Estuarine waters include the Atlantic Ocean tidal tributaries, and the Chesapeake Bay and its small coastal basins from the Virginia state line to the mouth of the bay (a line from Cape Henry drawn through Buoys 3 and 8 to Fishermans Island), and its tidal tributaries, excluding the Potomac tributaries and those tributaries listed in subdivisions 1 through 4 of this subsection.

6. Chowan River Basin. Tidal freshwater includes the Northwest River and its tidal tributaries from the Virginia-North Carolina state line to the free flowing portion, the Blackwater River and its tidal tributaries from the Virginia-North Carolina state line to the end of tidal waters at approximately state route 611 at river mile 20.90, the Nottoway River and its tidal tributaries from the Virginia-North Carolina state line to the end of tidal waters at approximately Route 674, and the North Landing River and its tidal tributaries from the Virginia-North Carolina state line to the Great Bridge Lock.

Transition zone includes Back Bay and its tributaries in the City of Virginia Beach to the Virginia-North Carolina state line.

D. Site-specific modifications to numerical water quality criteria.

1. The board may consider site-specific modifications to numerical water quality criteria in subsection B of this section where the applicant or permittee demonstrates that the alternate numerical water quality criteria are sufficient to protect all designated uses (see 9VAC25-260-10) of that particular surface water segment or body.

2. Any demonstration for site-specific human health criteria shall be restricted to a reevaluation of the bioconcentration or bioaccumulation properties of the pollutant. The exceptions to this restriction are for site-specific criteria for taste, odor, and aesthetic compounds noted by double asterisks in subsection B of this section and nitrates.

3. Procedures for promulgation and review of site-specific modifications to numerical water quality criteria resulting from subdivisions 1 and 2 of this subsection.

a. Proposals describing the details of the site-specific study shall be submitted to the board's staff for approval prior to commencing the study.

b. Any site-specific modification shall be promulgated as a regulation in accordance with the Administrative Process Act (§ 2.2-4000 et seq. of the Code of Virginia). All site-specific modifications shall be listed in 9VAC25-260-310 (Special standards and requirements).

E. Variances to water quality standards.

1. A variance from numeric criteria may be granted to a discharger if it can be demonstrated that one or more of the conditions in 9VAC25-260-10 H limit the attainment of one or more specific designated uses.

a. Variances shall apply only to the discharger to whom they are granted and shall be reevaluated and either continued, modified, or revoked at the time of permit issuance. At that time the permittee shall make a showing that the conditions for granting the variance still apply.

b. Variances shall be described in the public notice published for the permit. The decision to approve a variance shall be subject to the public participation requirements of the Virginia Pollutant Discharge Elimination System (VPDES) Permit Regulation, 9VAC25-31.

c. Variances shall not prevent the maintenance and protection of existing uses or exempt the discharger or regulated activity from compliance with other appropriate technology or water quality-based limits or best management practices.

d. Variances granted under this section shall not apply to new discharges.

e. Variances shall be submitted by the department's Division of Scientific Research or its successors to the U.S. Environmental Protection Agency for review and approval or disapproval.

f. A list of variances granted shall be maintained by the department's Division of Scientific Research or its successors.

2. None of the variances in this subsection shall apply to the halogen ban section (9VAC25-260-110) or temperature criteria in 9VAC25-260-50 if superseded by § 316(a) of the Clean Water Act requirements. No variances in this subsection shall apply to the criteria that are designed to protect human health from carcinogenic and noncarcinogenic toxic effects (subsection B of this section) with the exception of the metals, and the taste, odor, and aesthetic compounds noted by double asterisks and nitrates, listed in subsection B of this section.

#### F. Water effect ratio.

1. A water effects ratio (WER) shall be determined by measuring the effect of receiving water (as it is or will be affected by any discharges) on the bioavailability or toxicity of a metal by using standard test organisms and a metal to conduct toxicity tests simultaneously in receiving water and laboratory water. The ratio of toxicities of the metals in the two waters is the WER (toxicity in receiving water divided by toxicity in laboratory water equals WER). Once an acceptable WER for a metal is established, the numerical value for the metal in subsection B of this section is multiplied by the WER to produce an instream concentration that will protect designated uses. This instream concentration shall be utilized in permitting decisions.

2. The WER shall be assigned a value of 1.0 unless the applicant or permittee demonstrates to the department's satisfaction in a permit proceeding that another value is appropriate, or unless available data allow the department to compute a WER for the receiving waters. The applicant or permittee is responsible for proposing and conducting the study to develop a WER. The study may require multiple testing over several seasons. The applicant or permittee shall obtain the department's Division of Scientific Research or its successor approval of the study protocol and the final WER.

3. 9VAC25-31-230 C requires that permit limits for metals be expressed as total recoverable measurements. To that end, the study used to establish the WER may be based on total recoverable measurements of the metals.

4. The WER is established in a permit proceeding, shall be described in the public notice associated with the permit proceeding, and applies only to the applicant or permittee in that proceeding. The department's action to approve or disapprove a WER is a case decision, not an amendment to the present regulation.

The decision to approve or disapprove a WER shall be subject to the public participation requirements of Virginia Pollutant Discharge Elimination System (VPDES) Regulation, Part IV (9VAC25-31-260 et seq.). A list of final WERs will be maintained by the department's Division of Scientific Research or its successor.

5. A WER shall not be used for the freshwater and saltwater chronic mercury criteria or the freshwater acute and chronic selenium criteria.

G. Biotic Ligand Model for copper. On a case-by-case basis, EPA's 2007 copper criteria (EPA-822-F-07-001) biotic ligand model (BLM) for copper may be used to determine alternate copper criteria for freshwater sites. The BLM is a bioavailability model that uses receiving water characteristics to develop site-specific criteria. Site-specific data for 10 parameters are needed to use the BLM. These parameters are temperature, pH, dissolved organic carbon, calcium, magnesium, sodium, potassium, sulfate, chloride, and alkalinity. If sufficient data for these parameters are available, the BLM can be used to calculate alternate criteria values for the copper criteria. The BLM would be used instead of the hardness-based criteria and takes the place of the hardness adjustment and the WER. A WER will not be applicable with the BLM.

**9VAC25-260-170. Bacteria; other recreational waters.**

A. The following bacteria criteria (counts/100ml) shall apply to protect primary contact recreational uses in surface waters, except waters identified in subsection B of this section:

In freshwater, *E. coli* bacteria shall not exceed a geometric mean of 126 counts/100ml and shall not have greater than a 10% excursion frequency of a statistical threshold value (STV) of 410 counts/100 ml, both in an assessment period of up to 90 days.

In transition and saltwater, Enterococci bacteria shall not exceed a geometric mean of 35 counts/100ml and shall not have greater than a 10% excursion frequency of a statistical threshold value (STV) of 130 counts/100ml, both in an assessment period of up to 90 days.

1. See 9VAC25-260-140 C for boundary delineations for freshwater, transition, and saltwater.

2. In VPDES discharges to freshwater, bacteria in effluent requiring disinfection shall not exceed a monthly geometric mean of *E. coli* bacteria of 126 counts/100ml. Alternative performance standards may be established where an approved long term control plan establishes an alternative level of disinfection for a combined sewer system.

In VPDES discharges to transition and saltwater, bacteria in effluent requiring disinfection shall not exceed a monthly geometric mean of enterococci bacteria of 35 counts/100ml.

B. The following bacteria criteria per 100 ml (CFU/100 ml) of water shall apply:

*E. coli* bacteria shall not exceed a monthly geometric mean of 630 CFU/100 ml in freshwater.

Enterococci bacteria shall not exceed a monthly geometric mean of 175 CFU/100 ml in transition and saltwater.

1. See 9VAC25-260-140 C for boundary delineations for freshwater, transition, and saltwater.

2. Geometric means shall be calculated using all data collected during any calendar month with a minimum of four weekly samples.

3. If there is insufficient data to calculate monthly geometric means in freshwater, no more than 10% of the total samples in the assessment period shall exceed 1173 *E. coli* CFU/100 ml.

4. If there is insufficient data to calculate monthly geometric means in transition and saltwater, no more than 10% of the total samples in the assessment period shall exceed 519 enterococci CFU/100 ml.

5. Where the existing water quality for bacteria is below the geometric mean criteria in a water body designated for secondary contact in subdivision 6 of this subsection that higher water quality will be maintained in accordance with 9VAC25-260-30 A 2.

6. Surface waters designated under this subsection are as follows:

a. (Reserved)

b. (Reserved)

c. (Reserved)